Office Action Summary	Application No.	Applicant(s)	
	10/570,232	UENO, TAKAKUNI	
	Examiner	Art Unit	
	AMJAD ABRAHAM	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02/04/2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-5 and 7-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-5 and 7-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 November 2006* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *11/03/2009*.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *herewith* .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Applicant's remarks and amendments, filed on February 4, 2010, have been carefully considered. Claims 1 and 5 are currently amended by applicant. Claims 2 and 6 have been canceled. Thus, claims 1, 3-5, and 7-14 are now pending.

Grounds of rejections (maintained in part with changes to reflect amendments) based on applicant's amendments as filed on February 4, 2010

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 5, 8, 10, 12, and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Kihara et al. (Japanese Patent Publication JP 03-281329—made of record by applicant and translated by USPTO certified translator).

3. Regarding claims 1 and 12, Kihara teaches optical three-dimensional shaping method (stereolithographic) processes for forming a three dimensional object. The three-D shaping process exposes a light-curing **(photocurable)** resin to a light source by way of a two-axis direction **(planar)** exposure mask. **(See claim 1)**.

a. Kihara also goes on to teach

i. That the planar plotting mask can be continuously changed when projecting the mask image. **(See claim 1).**

ii. That the planar plotting mask moves continuously with respect to the resin surface during the 3D shaping process. **(See page 8 line 20 to page 9 line 11→ discussing the use of a controller, XY stage driver, and shutter plate to move the mask continuously to cure the resin.**

iii. Wherein the planar plotting mask and the XY stage driver continuously changes the shape of the mask and the position of the mask in synchronism. **(See page 9 lines 17-18)**.

iv. Wherein the build operation consists of overlapping adjacent plotted areas in order to make the boundary areas unnoticeable. **(See figures 2a -2f and page 8 lines 14-24)**.

(1) *Figures 2a-2f shows the synchronism between the changing of the mask and the movement of the mask in an XY position. As the mask translates position in figures 2a-2f there are points of overlapping in adjacent areas.*

v. A computer is used to control the movement of the mask and XY controller in order to overlap adjacent areas. **(See figure 1 part 8 which is a cad device which changes the mask along with the position of the mask).**

vi. Wherein the adjacent plotted areas can be in a curved state. **(See figures 2a-2c showing the formation of a curved 3 dimensional object.)**

(2) As the operation for forming the curved object is started the overlaps are continually formed on the adjacent plotting areas and when forming a curved part of the adjacent plotting areas the overlaps must also be curved.

4. Regarding claim 5, Kihara teaches an optical three-dimensional shaping apparatus. **(See claim 1 and figure 1).**

b. Kihara also teaches

vii. A photocurable resin supply means. **(See figure 1 (part # 2) disclosing a liquid resin supply vessel. Also see page 5 line 9 disclosing that resin is typically supplied layer by layer.)**

viii. A light source. **(See figure 1 (part number 4))**

ix. A two axis exposure mask (planar plotting mask). **(See part number 3 of figure 1 disclosing a liquid shutter plate that serves as the optical mask.)**

x. Moving means for moving mask. **(See part numbers 8, 10, and 11 of figure 1 disclosing moving means for mask/shutter system. Also see page 7 lines 4-24 disclosing the use of a XY stage driver to move the mask and scan the surface of the light curing resin in a two-dimensional direction.)**

(3) The claim limitation, "moving means for continuously moving the planar plotting mask", is a means plus function limitation that invokes 35 U.S.C. 112 6th paragraph and the corresponding structure is seen in page 44 lines 3-24 of applicant's specification. The use of a motor in conjunction with a drive source and a guide system is disclosed as the means necessary to move the planar plotting mask.

xi. Means for continuously changing the mask in synchronism with the movement of the mask. **(See part number 6 in figure 1 disclosing a liquid crystal shutter driver. See also page 9 lines 12-24 discloses the changing of a shutter system that is controlled by inputted shape data.)**

(4) The claim limitation, "means for continuously changing the mask image of the planar plotting mask in synchronism with movement of the planar plotting mask", is a means plus function limitation that invokes 35 U.S.C. 112 6th paragraph and the corresponding structure is seen in page 46 lines 12-25 of applicant's specification. The use of a shutter system (liquid-crystal shutter or a digital micromirror shutter) in conjunction with stored data on a computer is disclosed as the means necessary to move the continuously change the mask.

xii. Wherein the planar plotting mask and the XY stage driver continuously changes the shape of the mask and the position of the mask in synchronism. **(See page 9 lines 17-18)**.

xiii. Wherein the build operation consists of overlapping adjacent plotted areas in order to make the boundary areas unnoticeable. **(See figures 2a -2f and page 8 lines 14-24)**.

(5) *Figures 2a-2f shows the synchronism between the changing of the mask and the movement of the mask in an XY position. As the mask translates position in figures 2a-2f there are points of overlapping in adjacent areas.*

xiv. Wherein computer controls the adjacent plotted areas to form a curved part. **(See figures 2a-2c showing the formation of a curved 3 dimensional object.)**

(6) As the operation for forming the curved object is started the overlaps are continually formed on the adjacent plotting areas and when forming a curved part of the adjacent plotting areas the overlaps must also be curved.

5. Regarding 8, Kihara teaches the use of a liquid crystal shutter with the mask. **(See page 4 line 20).**

6. Regarding claims 10 and 14, Kihara teaches wherein the adjacent areas are overlapped during the synchronized stereolithographic procedure to create a high resolution part. **(See figures 2a -2f and page 8 lines 14-24)**.

c. *Figures 2a-2f shows the synchronism between the changing of the mask and the movement of the mask in an XY position. As the mask translates position in figures 2a-2f there are points of overlapping in adjacent areas.*

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 3-4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kihara et al. (Japanese Patent Publication JP 03-281329—made of record by applicant and translated by USPTO certified translator) in view of Smith (USP No. 6,500,378) in further view of Lercel (USP No. 6,461,797).

4. Regarding claim 3, Kihara does not teach wherein a planar plotting mask, in which a plurality of micro-optical shutters capable of blocking or allowing transmission of

light into microdot areas are arranged in a planar manner, is used as the planar plotting mask; and the surface of the photocurable resin composition is exposed to light while a mask image is continuously changed in accordance with a cross-sectional profile pattern to be formed by means of the plurality of micro-optical shutters during continuous movement of the planar plotting mask.

a. Smith teaches the use of a Spatial Light Modulator which is typically used in conjunction with micro-optical shutters. **(See abstract)**.

b. Furthermore, Lercel teaches the use of a plurality of micro-mirror shutters to allow for selective exposure of light towards photosensitive or UV curable materials. **(Column 7 lines 30-67, Column 8 lines 16-30, Column 9 lines 18-20, and figure 8)**

c. Kihara, Smith and Lercel are analogous art because they are from the same field of endeavor which is forming an object via stereolithography. At the time of the invention, it would have been obvious to one having the ordinary skill in the art, having the teachings of Kihara, Smith and Lercel before him or her, to modify the teachings of Kihara to include the teachings of Smith and Lercel for the benefit achieving increased light intensity control in order to incrementally alter light intensity in order to mesh the adjacent boundary layers together without a noticeable boundary.

5. Regarding claim 4, Kihara does not teach wherein the planar plotting mask has a liquid-crystal shutter or a digital micro-mirror (DMD) shutter arranged in a planar manner.

d. However, Smith teaches that a DMD device can be used with the spatial light modulator in order to alter the intensity or profile of the pattern. **(See column 9 lines 17-67)**.

e. The use of DMDs are known in the art and it would have been obvious to one having the ordinary skill in the art to use such a device to alter the intensity profile of the pattern used to form the 3D object.

6. Regarding claim 7, the combination of Kihara and Smith does not teach wherein the planar plotting mask is a planar plotting mask in which a plurality of micro-optical shutters capable of blocking or allowing transmission of light into microdot areas are arranged in a planar manner.

f. Smith teaches the use of a Spatial Light Modulator which is typically used in conjunction with micro-optical shutters. **(See abstract)**.

g. However, Lercel teaches the use of a plurality of micro-mirror shutters to allow for selective exposure of light towards photosensitive or UV curable materials. **(Column 7 lines 30-67, Column 8 lines 16-30, Column 9 lines 18-20, and figure 8)**

h. Kihara/Smith and Lercel are analogous art because they are from the same field of endeavor which is forming an object via lithography. At the time of the invention, it would have been obvious to one having the ordinary skill in the art, having the teachings of Kihara/Smith and Lercel before him or her, to modify the teachings of Kihara/Smith to include the teachings of Lercel for the benefit achieving increased light intensity control in order to incrementally alter light

intensity in order to mesh the adjacent boundary layers together without a noticeable boundary.

7. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kihara et al. (Japanese Patent Publication JP 03-281329—made of record by applicant and translated by USPTO certified translator) in view of Hennings (US Patent 3,718,396).

8. Regarding claim 9, Kihara does not teach wherein a light-condensing lens which is interposed between a light source and the planar plotting mask and can be continuously moved in synchronism with the planar plotting mask; and a projection lens which is interposed between the planar plotting mask and the surface of the photocurable resin composition and which can be continuously moved in synchronism with the planar plotting mask.

i. However, Hennings teaches the use of a condensing lens followed by a mask, which is followed by a projection lens to project an image to a substrate. **(See figure 2)**

i. The art taught be Hennings shows that it is well known to have a lithography set up which utilizes a projection and condensing lens to alter the intensity of a light source. Therefore, it would have been obvious to one skilled in the art to use a lens setup of this nature in order to have a lithography apparatus with a high degree of intensity and illumination control.

9. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kihara et al. (Japanese Patent Publication JP 03-281329—made of record by applicant and translated by USPTO certified translator) in view of Manning (USP No. 6,085,122).

10. Regarding claim 11, Kihara does not expressly teach performing an operation for making a total intensity of light radiated onto boundary areas among adjacent plotted areas in an optically-cured resin layer equal or analogous to the intensity of light radiated onto areas other than the boundary areas

j. However, Manning teaches that utilizing a constant laser energy flux density when performing a laser based rapid prototyping process (such as laser sintering or stereolithography) will eliminate defects such as ripples. **(See abstract, column 3 lines 18-44, and column 6 lines 27-45)**.

ii. Laser Energy Flux density, depends upon the laser energy, laser spot size, and exposure time of the laser onto the forming surface. **(See column 2 lines 7-9)**.

iii. If the same laser flux density is applied to each layer, adjacent surface, and overlapping surface the formed part will be uniform without any ridges or defect lines from points which where over conditioned or under conditioned. It would have been obvious to one having the ordinary skill in the art to ensure that each part (the adjacent plotted areas and the overlapping areas) is conditioned with the same laser flux density. This laser flux density is comparable to the intensity and thus one having the

ordinary skill in the art would know to eliminate possible defects like ridges by ensuring that the adjacent plotted areas and the overlapping areas have the same total laser flux density on each section.

11. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kihara et al. (Japanese Patent Publication JP 03-281329—made of record by applicant and translated by USPTO certified translator) in view of Gigl et al. (USP No. 6,264,873).

12. Regarding claim 13, Kihara does not teach wherein an operation is performed includes staggering positions of the boundary areas among the adjacent plotted areas in the optically-cured resin layer in vertically-stacked optically-cured resin layers.

k. However, Gigl discloses a staggering technique which staggers vertically stacked adjacent layers in an effort to impart better resolution while eliminating defects in an 3D part built by stereolithography. **(See column 2 lines 17-26 and column 14 lines 16-22 and column 23 lines 10-18)**. Gigl goes on to teach that staggering will lead to smoother vertical surfaces and a better overall part. Therefore, it would have been obvious to one having the ordinary skill in the art to stagger adjacent layers in an effort to improve resolution and eliminate surface defects leading to a smooth 3D object.

Response to Arguments

7. Applicant's arguments filed February 4, 2010 have been fully considered but they are not persuasive.

8. **Examiner clarification of Interview Summary disclosed in Applicant's remarks dated February 4, 2010**

d. It was agreed between applicant and examiner that the previous rejection of claim 2 would not stand due to a clarification as to the operation of option 1 of claim 2. Option 1 was discussed in view of Kihara, Smith, and/or Pollack. Examiner agreed that Kihara alone does not teach option 1 of applicant's claim 2 (now part of claim 1) and that further consideration was needed for the remaining options. In sum, examiner did not agree that Kihara did not teach all three options in claim 2 (not part of claim 1), just that Kihara did not teach option 1 since the previous rejection was concerned only with option 1.

9. **Applicant Argument:**

e. Applicant argues that it would have not been obvious to one having the ordinary skill in the art to modify the teachings of Kihara to include a manipulation of intensity and resolution of the laser step because Kihara inherently attenuates the formed object. **(See applicant's remarks 02-4-2009 page 8 lines 7-9 and 17-22)**.

10. **Examiner Response:**

f. First, examiner would like to point out that intensity control for attenuation is not required by independent claims 1 and 5, as it is one of three options given for attenuating the visual noticeability of the overlap.

g. Second, Kihara (inherently) also teaches the second option of performing an operation wherein the overlaps can be curved. **(See figures 2a-2c showing the formation of a curved 3 dimensional object)**. As the operation for forming the curved object is started the overlaps are continually formed on the adjacent plotting areas and when forming a curved part of the adjacent plotting areas the overlaps must also be curved.

h. Third, as Kihara uses essentially the same type of apparatus to preform the stereolithographic procedure as claimed by applicant, it can be optimized or modified.

xv. The laser system, positioning control, and CAD control set-up in Kihara can be individually controlled. It is well known that cure time and laser intensity are dependant on one another. Essentially the degree of cure is dependant on the laser intensity or Laser Energy Flux density.

xvi. See for example, Manning, which teaches that utilizing a constant laser energy flux density when performing a laser based rapid prototyping process (such as laser sintering or stereolithography) will eliminate defects such as ripples. **(See abstract, column 3 lines 18-44, and column 6 lines 27-45)**.

(7) Laser Energy Flux density, depends upon the laser energy, laser spot size, and exposure time of the laser onto the forming surface. **(See column 2 lines 7-9)**.

(8) If the same laser flux density is applied to each layer, adjacent surface, and overlapping surface the formed part will be uniform without any ridges or defect lines from points which where over conditioned or under conditioned. It would have been obvious to one having the ordinary skill in the art to ensure that each part (the adjacent plotted areas and the overlapping areas) is conditioned with the same laser flux density. This laser flux density is comparable to the intensity and thus one having the ordinary skill in the art would know to eliminate possible defects like ridges by ensuring that the adjacent plotted areas and the overlapping areas have the same total laser flux density on each section.

xvii. Therefore, one having the ordinary skill in the art would have sought to ensure that no exposed/cured part of Kihara was laser conditioned to a higher degree than another adjacent part or subject the part to a defect such as a ridge.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AMJAD ABRAHAM whose telephone number is

(571)270-7058. The examiner can normally be reached on Monday through Friday 8:00 AM to 5:00 PM Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Phillip Tucker can be reached on (571) 272-1095. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AAA

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